UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/848,921	05/19/2004	Kwang-Soon Kim	3364P168	5850

8791 7590 02/20/2008

BLAKELY SOKOLOFF TAYLOR & ZAFMAN
1279 OAKMEAD PARKWAY
SUNNYVALE, CA 94085-4040

EXAMINER	
LAM, KENNETH T	

ART UNIT	PAPER NUMBER
2611	

MAIL DATE	DELIVERY MODE
02/20/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/848,921	Applicant(s) KIM ET AL.	
	Examiner Kenneth Lam	Art Unit 2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 December 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____is/ are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *01/02/2008*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This office action is in response to the amendment filed on 12/07/2007. Claims 1-16 are amended.

2. The claim objection on Claim 15 has been clarified by the amendment; therefore, the objection to the claim is withdrawn.

3. Applicant's arguments regarding claims 1, 6, 10 and 14 have been fully considered but they are not persuasive. The examiner thoroughly reviewed Applicant's arguments but firmly believes that the cited reference reasonably and properly meets the claimed limitation as rejected.

Applicant's arguments: "Walton et al. does not disclose reporting back both the mean and the normalized standard deviation of the SNRs to the transmitter. Thus, Walton does not teach or suggest each of the elements of Claims 1, 6, 10 and 14 as amended".

The examiner's response: Walton et al. discloses a receiver processes received signal and provides channel state information then transmits the feedback signal to the transmitter ([0080], [0148]). Walton further discloses SNR of the transmission and noise variance (standard deviation is equal to square root of variance)

([0180]-[0187]), and deriving and reporting full or partial CSI ([0302]). Therefore, Walton et al. discloses reporting back both the mean and the normalized standard deviation of the SNRs to the transmitter.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

5. Claims 1-14 are rejected under 35 U.S.C. 102(a) as being anticipated by Walton et al. (Walton herein after), US 2003/0125040 A1.

Re Claim 1, Walton discloses an adaptive transmitter in a wireless communication system using frequency division duplexing (*Background, [0004]*), comprising:

a modulation and encoding method (*[0011]*) and transmit power determining unit (*[0013]*) for determining an antenna method (*[0006]*), a modulation and encoding method, and a corresponding transmit power according to parameters (received log likelihood ratio parameters) fed back from a receiver, the parameters including a mean and a normalized standard deviation of SNRs calculated by the receiver (*a receiver*

processes received signal and provides channel state information then transmits the feedback signal to the transmitter [0080], [0148], SNR of the transmission and noise variance (standard deviation is equal to square root of variance) [0180]-[0187]), *and deriving and reporting full or partial CSI [0302]*)-*[0538]*); and

an encoder and modulator for adaptively transmitting the traffic data to the receiver according to the antenna method, the modulation and encoding method, and the transmit power determined by the modulation and encoding method and transmit power determining unit (*[0014]*).

Re Claim 2, Walton further discloses the adaptive transmitter of claim 1, wherein the modulation and encoding method and transmit power determining unit comprises:

a per-modulation-encoding-method target mean received SNR (i.e., signal to noise ratio) table for predefining target mean received SNR per modulation encoding method (*[0076]*);

a transmit power increase table for establishing per-modulation-encoding-method compensated power values that correspond to the received log likelihood ratio parameters fed back from the receiver (*[0093]*);

a transmit power determining unit (*Figure 3B*) for using the compensated power value output from the per-modulation-encoding-method target mean received SNR table and the compensated power value output from the transmit power increase table according to the received log likelihood ratio parameters and determining compensated

power values of the corresponding antenna method, the modulation method, and the encoding method (*[0105]*); and

an antenna/modulation/encoding method determining unit for determining the antenna method and the modulation and encoding method corresponding to the compensated power values determined by the transmit power determining unit, and outputting them to the encoder and modulator (*[0104]*).

Re Claim 3, Walton further teaches the adaptive transmitter of claim 1, wherein the received log likelihood ratio parameters (*[0167]*) include the mean and the normalized standard deviation of the SNRs calculated by the receiver from at least one of a combined channel gain or a spatial channel gain(*[0163], [0180]-[0187]*).

Re Claim 4, Walton further teaches the adaptive transmitter of claim 1, wherein the modulation and encoding method and transmit power determining unit comprises:

a per-modulation-encoding-method target mean received SNR table for presetting target mean SNR per modulation encoding method (*[0076]*);

a transmit power increase table for setting per-modulation-encoding-method compensated power values corresponding to the normalized standard deviation of the SNRs fed back from the receiver (*[0093]*);

a transmit power determining unit (*controller **230**, Figure 2A*) for using the target power output from the per-modulation-encoding-method target mean received SNR table, the compensated power value according to the mean of the SNRs fed back from the receiver, and the compensated power value output by the transmit power increase table according to the normalized standard deviation of the fed-back SNRs, and determining the compensated power values on the corresponding antenna method and the modulation and encoding method (*[0105], [0180]-[0187]*); and

an antenna/modulation/encoding method determining unit for determining the antenna method and the modulation and encoding method which correspond to the compensated power values determined by the transmit power determining unit, and outputting them to the encoder and modulator (*Figure 3B, [0104]*).

Re Claim 5, Walton further teaches the adaptive transmitter of claim 3, wherein the received log likelihood ratio parameters include the mean and the normalized standard deviation of the combined SNRs calculated by the receiver in the case of using diversity transmission (*[0165]*),

the parameters include the mean and the normalized standard deviation of the spatial channel SNRs calculated by the receiver in the case of using spatial multiplexing transmission (*[0157]*), and

the parameters include the mean and the normalized standard deviation of the combined SNRs calculated by the receiver (*[0152]*), and a mean and a normalized

standard deviation of the spatial channel SNRs calculated by the receiver in the case of using both diversity transmission and spatial multiplexing transmission (*[0116], [0174], [0195]*).

Re Claim 6, Walton discloses an adaptive receiver in a wireless communication system using frequency division duplexing (*Background, [0004]*), comprising:

a demodulator and decoder for receiving signals from a transmitter, and demodulating and decoding the signals (*Receiver* ***106a****, Figure* 2B);

an SNR (i.e., signal to noise ratio) measuring unit for estimating channel gains or an SNRs in a single code block through preambles or pilots output by the demodulator and decoder (*[0011], [0177]*); and

a received log likelihood ratio parameter determining unit for finding parameters including a mean and a normalized standard deviation of the SNRS in the single code block from the channel gains or the SNRs estimated by the SNR measuring unit (*[0012]*), and feeding the parameters back for adaptive transmission of the transmitter (*[0152], [0211], a receiver processes received signal and provides channel state information then transmits the feedback signal to the transmitter [0080], [0148], SNR of the transmission and noise variance (standard deviation is equal to square root of variance) [0180]-[0187]*), *and deriving and reporting full or partial CSI [0302])-[0538]*).

Re Claim 7, Walton further teaches the adaptive receiver of claim 6, wherein the received log likelihood ratio parameter determining unit comprises:

a diversity received log likelihood ratio parameter determining unit (*Figure 4A-G*) for calculating combined SNRs from the channel gains or the SNRs estimated by the SNR measuring unit (*[0195]*), determining a diversity received log likelihood ratio parameters (*[0213]*), and outputting the parameters to the transmitter (*[0011]*); and

a spatial multiplexing received log likelihood ratio parameter determining unit for calculating SNRs of spatial channels from the channel gains or the SNRs estimated by the SNR measuring unit (*[0069]*), determining a spatial multiplexing received log likelihood ratio parameters, and outputting the parameters to the transmitter (*[0172], [0211]*).

Re Claim 8, Walton further teaches the adaptive receiver of claim 7, wherein the diversity received log likelihood ratio parameter determining unit (*[0165]*) comprises:

a combined channel gain calculator (spatial/space-time processor ***410c**, Figure 4C*) for receiving per-transmit/receive-antenna channel gain or SNR for each symbol in a single code block from the SNR measuring unit, and finding the combined channel gain and the combined SNR of each symbol in the code block (*[0208]-[0212]*); and

a mean and normalized standard deviation calculator (*adaptive processor **428**, Figure 4C*) for finding a mean and a normalized standard deviation of the combined SNRs in the single code block obtained from the combined channel gain calculator,

setting them as the diversity received log likelihood ratio parameters, and feeding the parameters back to the transmitter (*[0195]*).

Re Claim 9, Walton further teaches the adaptive receiver of claim 7, wherein the spatial multiplexing received log likelihood ratio parameter determining unit (*[0069]*) comprises:

a spatial channel gain calculator (*spatial/space-time processor **410b**, Figure 4B*) for receiving a channel gain matrix of each symbol in the single code block from the SNR measuring unit, and finding singular values of the matrix or the SNR of the respective spatial channels (*[0173]-[0185]*); and

a mean and normalized standard deviation calculator (*channel estimator **418**, Figure 4B*) for finding the mean and the normalized standard deviation of the spatial channel gain or the spatial channel SNR in the single code block found from the spatial channel gain calculator, setting them as the spatial multiplexing received log likelihood ratio parameters, and feeding the parameters back to the transmitter (*[0172], [0188]-[0194]*).

Re Claim 10, Walton discloses an adaptive transmitting method of a wireless communication system using frequency division duplexing (*Background, [0004]*), comprising:

(a) transmitting a pilot or a preamble to a receiver by using a predefined transmit power (*[0092], [0098]*);

(b) determining an antenna method, a modulation and encoding method, and a transmit power based on the parameters (received log likelihood ratio parameters) fed back from a receiver, the parameters including a mean and a normalized standard deviation of SNRs calculated by the receiver (*[0093], [0100] a receiver processes received signal and provides channel state information then transmits the feedback signal to the transmitter [0080], [0148], SNR of the transmission and noise variance (standard deviation is equal to square root of variance) [0180]-[0187]*), *and deriving and reporting full or partial CSI [0302])-[0538]*); and

(c) transmitting traffic data to the receiver by using the determined antenna method, the modulation and encoding method, and the transmit power (*[0011]*).

Re Claim 11, Walton further teaches the adaptive transmitting method of claim 10, wherein (b) comprises presetting and storing the performance of all the antenna/modulation/encoding methods used by an adaptive transmitter with respect to the pre-determined quantized values of the received log likelihood ratio parameters (*Figure 2B, [0550]*), and calculating transmit power needed for obtaining target performance on each antenna/modulation/encoding method from the received log likelihood ratio parameters fed back from the receiver (*controller **230**, scheduler **234**, Figure 2B, [0081]-[0083]*).

Re Claim 12, Walton further teaches the adaptive transmitting method of claim 10, wherein (b) comprises finding a transmit power needed for further compensating for

the mean of received SNR for achieving target performance on the predefined antenna methods and the modulation and encoding methods (*Figure 3B, [0105]*), and a compensated transmit power for achieving target performance on the predefined antenna methods and the modulation and encoding methods from the received log likelihood ratio parameters fed back from the receiver (*[0106]-[0113]*).

Re Claim 13, Walton further teaches the adaptive transmitting method of claim 10, wherein (b) comprises:

compensating for a difference between the mean of received SNR for achieving target performance on the predefined antenna methods and the modulation and encoding methods and the mean of the received SNR fed back from the receiver (*[0082]*); and

finding a transmit power so as to compensate for a compensated transmit power further needed for achieving target performance on the predefined antenna methods and the modulation and encoding methods from the normalized standard deviation of the SNRs fed back from the receiver (*[0085]*).

Re Claim 14, Walton discloses an adaptive receiving method of a wireless communication system using frequency division duplexing, comprising:

(a) estimating a complex channel gain (the complex channel gain being from a transmit antenna to a receive antenna) of each symbol in a single code block through a pilot or a preamble transmitted from a transmitter (*[0097]*);

(b) calculating parameters (received log likelihood ratio parameters) including a mean and a normalized standard deviation of SNRs from the estimated complex channel gain (from a transmit antenna to a receive antenna) of each symbol in a single code block (*[0165], [0195], [0213], a receiver processes received signal and provides channel state information then transmits the feedback signal to the transmitter [0080], [0148], SNR of the transmission and noise variance (standard deviation is equal to square root of variance) [0180]-[0187]*), *and deriving and reporting full or partial CSI [0302])-[0538]*); and

(c) feeding the calculated received log likelihood ratio parameters to the transmitter for adaptive transmission in the transmitter (*[0153]*).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in **Graham v. John Deere Co., 383 U.S. 1, 148 USPQ 459 (1966)**, that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows: ***(See MPEP Ch. 2141)***

a. Determining the scope and contents of the prior art;
b. Ascertaining the differences between the prior art and the claims in issue;
c. Resolving the level of ordinary skill in the pertinent art; and
d. Evaluating evidence of secondary considerations for indicating obviousness or nonobviousness.

7. Claims 15 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Walton et al. (Walton herein after), US 2003/0125040 A1.

Re Claim 15, Walton discloses the adaptive receiving method of claim 14, wherein when the receiver uses diversity in (b), the SNR of the l-th element of the received symbol vector after processing, $SNR_i = \frac{\overline{\left|\hat{x}_i\right|^2}}{\sigma_{n'}^2}$ (Equation 11), and are found by the subsequent equation $r = Hx + n$ (Equation 6), and $\hat{x}_{total} = \sum_{i=1}^{N_T} \frac{\hat{x}_i}{r_{ii}}$ (Equation 12). However, Walton does not teach the anticipated combined channel gain h_l' of the l^{th} symbol in a code block and the combined SNR $\frac{\left|h_l'\right|^2}{2\sigma^2}$ are found by the subsequent equation

$$z = \left|h'\right|x + n''$$

$$\left|h'\right|^2 = \sum_{a=0}^{N_T-1} \sum_{b=0}^{N_R-1} \left|h_{a,b}\right|^2$$

where x is a transmit symbol with the normalized energy of 1, n" is complex normal noise with a mean value of 0 and a variance of $2\sigma^2$, N_T is a number of transmit antennas, N_R is a number of receive antennas, l includes a number of from 0 to L-1 (L is a number of symbols in the code block), and $h_{a,b}$ is a complex gain of from the a^{th} transmit antenna to the b^{th} receive antenna (*[0172]*), and z is a channel compensated and maximally combined symbol (*a receiver processes received signal and provides*

channel state information then transmits the feedback signal to the transmitter [0080], [0148], SNR of the transmission and noise variance (standard deviation is equal to square root of variance) [0180]-[0187]), *and deriving and reporting full or partial CSI [0302])-[0538]*), and

the mean and the normalized standard deviation of the found combined SNR are the received log likelihood parameters (*[0195]*).

On the other hand, Walton teaches an equivalent theory and obvious equations for the combined SNR as shown in Equations 11, 6 and 12. Therefore, it would have been obvious to one skilled in the arts at the time of the invention was made to reformulate the equations from Walton's disclosure to improve the signal to noise ratio.

Re Claim 16, Walton discloses the adaptive receiving method of claim 14, wherein when the receiver uses spatial multiplexing in (b), variance of the l-th transmitted symbol $\left|\hat{x}_i\right|^2$ is equal to one on the average, then the SNR as, $SNR_i = \frac{1}{r_{ii}\sigma_n^{\;2}}$ (Equation 12) where r is the received symbol vector included the channel gains. However, Walton does not teach the exact formula as recited, $\sqrt{\lambda_{i,l}}, i = 0,..., N_T - 1$ which is the singular value of the channel gain matrix of the l[th] symbol in a single code block, and the SNR $\frac{\lambda_{i,l}}{2\sigma^2}$ (*[0184]*) of respective spatial channels, are found by using a characteristic that the distribution of the received log likelihood ratio corresponds to the

distribution of the log likelihood ratio received through channels having the number N_T of the antennas of the transmitter having the respective channel gains as $\sqrt{\lambda_i}$ (*[0187]*), and

the mean and the normalized standard deviation of the found spatial channel SNR are the received log likelihood parameters (*[0195]*).

On the other hand, Walton teaches an equivalent theory and obvious equations for the combined SNR. Therefore, it would have been obvious to one skilled in the arts at the time of the invention was made to reformulate the equations from Walton's disclosure to improve the signal to noise ratio.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Walton et al., US 2004/0120411 A1

  Closed-loop rate control for a multi-channel communication system

- Jootar et al., US 7,155,177 B2

  Weight prediction for closed-loop mode transmit diversity

- Hottinen et al., US 7,200,368 B1

  Transmit diversity method and system

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kenneth Lam whose telephone number is (571) 270-1862. The examiner can normally be reached on Mon - Thu 7:30 am - 5:00 pm EST ALT Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shuwang Liu can be reached on (571) 272-3036. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KENNETH LAM/
02/18/2008

SHUWANG LIU
SUPERVISORY PATENT EXAMINER